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PATENT ABSTRACTS OF JAPAN

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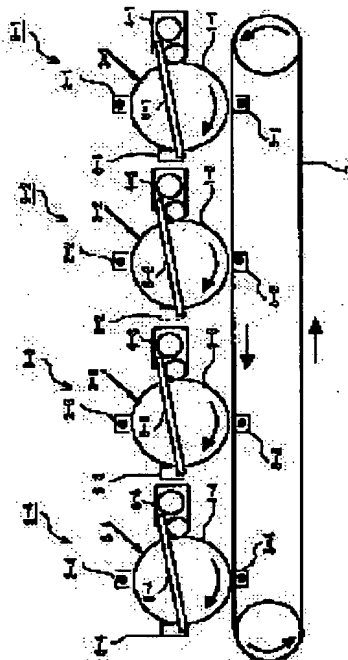
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(54) COLOR IMAGE FORMING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a color image forming device making the satisfactory color image possible to be formed over a long period by performing toner recycle, in reducing the development trouble derived from the color mixture of the toner, in the color image forming device, respectively provided with plural independent image-forming parts for each color.

SOLUTION: In this color image forming device performing the toner recycle, the charge polarity of respective color toner is made the same thereto. Then, binding resin and particle size distribution of the respective color the toner is made the same thereto. Moreover, developing means 4-1, 4-2, 4-3 and 4-4 is respectively set to identical specifications. Furthermore, in the case of adopting the two component developer, each carrier in the color developers is made identical.



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CLAIMS

[Claim(s)]

[Claim 1] Two or more image support by which an electrostatic latent image is formed in the surface A coloring agent which corresponds an electrostatic latent image which held two or more developers which consist of a mutually different coloring agent, and was formed in each of two or more of said image support It is color picture formation equipment equipped with the above, and a coloring agent with which said two or more developers differ is characterized by having the same electrification polarity.

[Claim 2] A coloring agent with which said two or more developers differ is color picture formation equipment according to claim 1 characterized by having the same binding resin.

[Claim 3] A coloring agent with which said two or more developers differ is color picture formation equipment according to claim 1 or 2 characterized by having almost same particle size distribution.

[Claim 4] Said developer is claim 1 characterized by having the same specification, and color picture formation equipment according to claim 2 or 3.

[Claim 5] Said developer is claim 1 characterized by being the 2 component developer which holds a two component developer which consists of a toner and a carrier, and said two or more developers having the same carrier, claim 2, and color picture formation equipment according to claim 3 or 4.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]**[0001]**

[The technical field to which invention belongs] This invention develops the electrostatic latent image formed on image support with the developer of each color, and relates to full color image formation equipments, such as a copying machine which obtains the full color last image, a printer, and facsimile.

[0002]

[Description of the Prior Art] After electrifying uniformly the surface of the photo conductor which has a sensitization layer in the image formation equipment of an electrophotography method generally, image exposure is performed, an electrostatic latent image is formed on the surface of a photo conductor, this electrostatic latent image is developed with a toner, a toner image is formed, this toner image is further imprinted to a transfer paper, and image formation is performed. On the other hand in the photo conductor surface after an imprint, the toner which was not imprinted remains, cleaning equipment removes this residual toner, and it prepares for new image formation. Although the toners removed by cleaning equipment are discarded after they are collected in cleaning equipment, they have the problem that the problem of the environmental pollution by the complicatedness which does an abandonment activity whenever the container for toner recycling is full in this case, and the abandonment toner, and use of a developer do not accomplish effectively.

[0003] For this reason, with the image formation equipment using a monochromatic toner, the toner cleaned and collected is returned in a development means, and the toner recycle device again used for development has been widely used recently, for example so that it may be indicated by JP,56-21175,A. Moreover, also about the toner, as technology of decreasing an abandonment toner, the conveyance nature and endurance of a ** toner are raised, and the configuration of a toner is improved, or in the toner of dry type 2 component development, the method of improving toner particle size distribution is proposed so that it may be indicated by JP,2-157765,A, so that it may be indicated by JP,1-214874,A and JP,2-110572,A.

[0004] In recent years, by development of a computer, color facsimile, a color printer, etc., the need of full color image formation equipment is growing, and the recovery toner has also been increasing in connection with this. About disposal of such a recovery toner, it is full color and the need for toner recycle has been emphasized rather than monochrome image formation equipment with full color image formation equipment from problems, like that the container stored in order that the amount of toners to be used may discard a recovery toner, since many [compared with the amount of toners used in one color] is enlarged, and the material of harmful nature is included. However, when toner recycle is performed in conventional full color image formation equipment, Since the imprint residual toner is considered as the configuration which cleans with a cleaner etc. and brings the collected waste toner together in the shared container for waste toner recycling after developing the electrostatic latent image on a photo conductor with the development means of each color and imprinting to a transfer paper, The collected waste toner was not able to change into the condition that the toner of each color was mixed, and was not able to be again used for color development.

[0005] As a method of coping with this problem, it has toner cleaning equipment only for two or more photo conductors for every color, and each photo conductors, the toner image of each color is formed, the toner which remains on two or more photo conductors with which the imprint was performed is cleaned according to an individual, and the technology which collects in the container for toner recycling according to color, and is again used for development is indicated by JP,9-288397,A.

[0006]

[Problem(s) to be Solved by the Invention] However, there is a problem shown below in the above-mentioned Prior art. Although the method indicated by JP,9-288397,A is enabling toner recycle in full color image formation equipment by preparing two or more photo conductors for every color, and collecting each color toners according to a color with the toner cleaning equipment of dedication, color mixture occurs in fact. As a result of analyzing the cause of such color mixture, it became clear that some toner images already imprinted with the development means in the upstream of the development means carried out reverse transcription to a photo conductor, and it was mixed in a cleaning means with the transfer residual toner at the production process which imprints the color toner image arranged at the development means. And since this reverse transcription phenomenon cannot be abolished completely, in above equipment, color mixture is unavoidable.

[0007] This invention is offering the color picture formation equipment which toner recycle is performed while it accomplishes in view of the above troubles and the purpose's reduces the development trouble by the color mixture of a toner in color picture formation equipment, and can form a color picture with a good passage at a long period of time.

[0008]

[Means for Solving the Problem] In order to solve the above-mentioned trouble, invention according to claim 1 Two or more image support by which an electrostatic latent image is formed in the surface Two or more developers which consist of a mutually different coloring agent are held. Two or more developers developed with said developer which has a coloring agent which corresponds an electrostatic latent image formed in each of two or more of said image support, Two or more cleaning means to remove and collect developers of a surplus which remains on said two or more image support for every image support, It has a toner recycle means to return a toner collected by said cleaning means in each developer. While piling up and imprinting a toner image formed on said two or more image support on a record medium one by one and obtaining the last image In color picture formation equipment which uses again each developer removed from said two or more image support A coloring agent with which said two or more developers differ offers color picture formation equipment which has the same electrification polarity.

[0009] Invention according to claim 2 offers color picture formation equipment according to claim 1 with which a coloring agent with which said two or more developers differ has the same binding resin.

[0010] Invention according to claim 3 offers color picture formation equipment according to claim 1 or 2 with which a coloring agent with which said two or more developers differ has almost same particle size distribution.

[0011] Invention according to claim 4 offers claim 1 in which said developer has the same specification, and color picture formation equipment according to claim 2 or 3.

[0012] Invention according to claim 5 is a 2 component developer which holds a two component developer to which said developer changes from a toner and a carrier. Said two or more developers offer claim 1 which has the same carrier, claim 2, and color picture formation equipment according to claim 3 or 4.

[0013]

[Embodiment of the Invention] Hereafter, the gestalt of operation of the color picture formation equipment of this invention is explained based on drawing. Drawing 1 is the outline block diagram showing claim 1 of this invention, claim 2, claim 3, and color picture formation equipment according to claim 4 or 5. This color picture formation equipment is a full color system which has the photo conductor of the shape of four drum, and has the four image formation sections which the first image formation section 9-1, the second image formation section 9-2, the third image

formation section 9-3, and the fourth image formation section 9-4 became independent of. These image formation sections 9-1, 9-2, 9-3, and 9-4 It is arranged the photo conductor 1-1 which is image support, respectively, 1-2, 1-3, 1-4, and near the peripheral surface of a photo conductor. The surface of a photo conductor on the surface of an electrification means 2-1 by which it is charged uniformly, 2-2, 2-3, 2-4, a photo conductor 1-1, 1-2, 1-3, and 1-4 The coloring toner corresponding to the exposure means 3-1 for exposing and writing in the image data whose color was separated, 3-2, 3-3, 3-4, and the image data whose color was separated is held. A corresponding coloring toner image A cleaning means 6-1 to remove the transfer residual toner on a development means 4-1 to form, 4-2, 4-3, 4-4, an imprint means 5-1 to imprint the toner image formed on the photo conductor on the recording paper, 5-2, 5-3, 5-4, a photo conductor 1-1, 1-2, 1-3, and 1-4, 6-2, 6-3, It has 6-4, a recycle means 8-1 to return the transfer residual toner collected by the cleaning means in the development means 4-1, 4-2, 4-3, and 4-4, 8-2, 8-3, and 8-4 grade. The sequential array of the above-mentioned photo conductor 1-1, 1-2, 1-3, and 1-4 is carried out along the conveyance direction of the conveyance belt 7, and the above-mentioned imprint means 5-1, 5-2, 5-3, and 5-4 are arranged so that it may counter on the surface of a photo conductor through this conveyance belt 7.

[0014] The above-mentioned photo conductor 1-1, 1-2, 1-3, and 1-4 consist of an OPC drum, and are supported pivotable in the direction of an arrow head. The above-mentioned development means 4-1, 4-2, 4-3, and 4-4 While holding in the interior the black toner B which is the cyanogen toner C which are the Magenta toner M which are the yellow toner Y which is a toner of the first color, respectively, and a toner of the second color, and a toner of the third color, or a toner of the fourth color It is arranged in the location adjacent to the surface of a photo conductor 1-1, 1-2, 1-3, and 1-4. It has the toner feed roller arranged in the back upper part of the developing roller supported so that it may rotate in the hand of cut of a photo conductor, and the direction of reverse, and a developing roller, and the toner within a development means is supplied to a developing-roller side by the toner feed roller, and is pumped up on the surface of a developing roller. The above-mentioned conveyance belt 7 moves in the direction of an arrow head, being laid with two rollers which rotate in the direction of an arrow head, and the recording paper is conveyed in the imprint location in which the imprint means 5-1, 5-2, 5-3, and 5-4 were arranged.

[0015] Actuation of the above-mentioned full color system is explained. When this full color system performs image formation, the surface of the photo conductor 1-1 of the four image formation sections 9-1, 9-2, 9-3, and 9-4, 1-2, 1-3, and 1-4 is first charged uniformly, respectively by the electrification means 2-1, 2-2, 2-3, and 2-4. Then, by the exposure means 3-1, 3-2, 3-3, and 3-4, it exposes to the image data whose color was separated, and an electrostatic latent image is formed. Thus, the electrostatic latent image formed in the surface of a photo conductor 1-1, 1-2, 1-3, and 1-4 is conveyed with rotation of a photo conductor to the development means 4-1, 4-2, 4-3, 4-4, and the development field that counters. On the other hand in development means 4-1, 4-2, 4-3, and 4-4, the yellow toner and Magenta toner and cyanogen toner or black toner is held, respectively, these toners are conveyed by the toner feed roller at a developing-roller side, respectively, and it is pumped up on a developing roller with rotation of a developing roller, it is conveyed to a development field, an electrostatic latent image is adsorbed, and the toner image of each color is formed. The toner image by the yellow toner of the first image formation section 9-1 is first imprinted by the recording paper which the toner image of each color formed in the surface of a photo conductor 1-1, 1-2, 1-3, and 1-4 was conveyed by rotation of a photo conductor in the location where the imprint means 5-1, 5-2, 5-3, and 5-4 have been arranged further, and has been conveyed with the conveyance belt 7. The recording paper with which this yellow toner image was imprinted The conveyance belt 7 top is conveyed and sequential migration is carried out to the second image formation section 9-2, the third image formation section 9-3, and the fourth image formation section 9-4. After the toner image by the Magenta toner, the toner image by the cyanogen toner, and the toner image by the black toner pile up one after another and are imprinted as a full color image, it is conveyed by the fixing means which is not illustrated and the full color image to which the recording paper was fixed is formed.

[0016] The toner of each color which remained after the above-mentioned toner image imprint on the surface of a photo conductor 1-1, 1-2, 1-3, and 1-4 While exfoliating from the photo conductor surface, respectively with the toner blade in which was conveyed in the arrangement location of the cleaning means 6-1, 6-2, 6-3, and 6-4, and contact arrangement was carried out by rotation of a photo conductor on the surface of the photo conductor It is collected in the cleaning means 6-1, 6-2, 6-3, and 6-4, is guided through the recycle means 8-1, 8-2, 8-3, and 8-4 in the development means 4-1, 4-2, 4-3, and 4-4 from here, it is mixed with a new toner, and is again used for development.

[0017] With this operation gestalt, each image formation section 9-1, 9-2, 9-3, and 9-4 have been independent, and the cleaning means 6-1 of each image formation section, 6-2, 6-3, and 6-4 remove the toner which remains on the surface of the same photo conductor 1-1 of image formation circles, 1-2, 1-3, and 1-4. For this reason, although only the corresponding toner (a yellow toner, a Magenta toner, a cyanogen toner, or black toner) of Isshiki should exist in each cleaning means, the toner of two or more colors is intermingled in fact. The place which investigated the toner in the cleaning means 6-1, 6-2, 6-3, and 6-4 after image formation by this full color system, In the cleaning means 6-1 of the first image formation section, the toner (yellow toner) of the first color In the cleaning means 6-2 of the second image formation section, the toner of the first color and the toner (Magenta toner) of the second color In the cleaning means 6-3 of the third image formation section, the toner of the first color, the toner of the second color, and the toner (cyanogen toner) of the third color In the cleaning means 6-4 of the fourth image formation section, the toner of the first color, the toner of the second color, It turned out that the toners which the toner of the third color and the toner (black toner) of the fourth color exist, and exist in the Nth cleaning means of the image formation section are the toner of the Nth color, and a toner (N in however, this case the number of either 1-4) of all the colors before it.

[0018] Thus, as a result of analyzing the cause that the toner of two or more colors is intermingled in the cleaning means 6-1, 6-2, 6-3, and 6-4, it sets to the development means 4-1 of each image formation section, 4-2, 4-3, and 4-4. It became clear that some toner images already imprinted by the transfer paper in the image formation section arranged in the upstream of the image formation section carried out reverse transcription to a photo conductor, and it was mixing to the cleaning means with the transfer residual toner at the production process which imprints the toner image of the coloring toner held in the development means. When imprinting a toner image to a transfer paper with the toner (Magenta toner) of the second color held in the development means 4-2 of the second image formation section 9-2, for example, to this transfer paper In order to be the first image formation section 9-1, to already have imprinted the toner image by the toner (yellow toner) of the first color and for a part of this yellow toner image to carry out reverse transcription on the photo conductor 1-2 of the second image formation section, Two kinds of toners, a yellow toner and a Magenta toner, exist on a photo conductor 1-2 as a transfer residual toner. Since these toners are eliminated from a photo conductor 1-2 by the cleaning means 6-2 and are collected in the cleaning means 6-2, a yellow toner and a Magenta toner will be intermingled in the cleaning means 6-2.

[0019] Furthermore, the relation of the generating and the imprint conditions (conditions of the voltage impressed to an imprint means in order to generate the imprint electric field which move a toner to a transfer paper) of this reverse transcription phenomenon was investigated. Consequently, although the conditions from which the amount of reverse transcription toners serves as the minimum existed as shown in drawing 2, it became clear that a reverse transcription toner was not set to 0. It was thought that migration from the recording paper of a reverse transcription toner to [from this result] a photo conductor side was performed depending on force other than electrostatic force. And since this force is uncontrollable, generating of a reverse transcription toner cannot usually be set to 0. Therefore, in a cleaning means, the following states on the assumption that a certain amount of color mixture exists.

[0020] Although filming will be caused into the material (a 2 component development method a carrier and a 1 component development method developing roller) to which frictional electrification of the toner is carried out or the fault of toner concentration control becoming

impossible etc. will arise if the toner which is not developed and which carried out color mixture is saved up in a development means. Big fault will not be produced if negatives are developed like [the amounts of toners of the upstream which carries out color mixture by reverse transcription etc. are very few in fact, and] the coloring toner originally held in the development means, without collecting in a development means. For this reason, as for the toner which carried out color mixture, it is desirable for negatives to be developed with an original toner and not to collect in a development means. It depends for a color mixture ratio on the amount of reverse transcription toners in the condition that a color mixture toner is also developed by coincidence. If the amount of toners which carries out color mixture by reverse transcription is made into 5% of the amount of development toners, a final color mixture ratio is also saturated with 5%.

[0021] In order to develop a color mixture toner in the usual development, with this operation gestalt, all of four development means for each colors were made into the same specification. Thus, the toner which carried out color mixture can be developed like the toner of an original color by developing negatives on the same conditions about a development means, using the member of the same specification especially as a developing roller. Moreover, with this operation gestalt, the following materials were used about the toner and the carrier using the two component developer which consists of a toner and a carrier. The toner considered electrification polarity of each color toner as minus, used as polyester resin all the binding resin that forms each color toner, made all the particle size distributions of each color toner further the mean particle diameter of 6.5×0.5 micrometers, and about the carrier, each color used the same thing and it considered it as the configuration which performs reversal development. When the full color system of this operation gestalt which has such a configuration performed color picture formation, it was checked that a toner carries out color mixture and does not collect in a development means even if it carries out toner recycle, but the stable image quality is acquired.

[0022] In the above-mentioned configuration, since the electrification trains of each quality of the material differ when the toner with which binding resin differs between each color is used, a frictional electrification property changes, an action which is different with a color mixture toner and an original coloring toner cannot be shown, and the stable image cannot be obtained. Moreover, when the particle size distributions of each color toner differ, particle size distributions differ with the toner which carried out color mixture, and an original coloring toner, a touch area with the material (a 2 component development method a carrier and a 1 component development method developing roller) by which frictional electrification is carried out to a toner changes, and a difference arises in the average amount of electrifications with a color mixture toner and an original coloring toner. For this reason, such a toner shows a mutually different action at the time of development, and affects image formation. For example, when mean particle diameter of all coloring toners is set to 6.5×0.5 micrometers, By the case where set mean particle diameter of a black toner to 10.0×0.5 micrometers, and mean particle diameter of all the toners (a yellow toner, a Magenta toner, and cyanogen toner) except a black toner is set to 6.5×0.5 micrometers. When the development which carries out toner recycle was compared and mean particle diameter of all coloring toners is made into the same range. In the example which made only mean particle diameter of a black toner a different range from the mean particle diameter of other coloring toners, the selection phenomenon which the small coloring toner of mean particle diameter concentrates on the edge section of a solid image occurred to the color mixture toner and the original coloring toner having been developed similarly. Therefore, all the development means for each colors are made into the same specification, the electrification polarity of each color toner and particle size distribution are the same, and it turned out that it becomes possible to acquire the stable image quality, recycling a color toner by using the developer using the carrier same in a two component developer using the same binding resin.

[0023]

[Effect of the Invention] As explained above, the color picture formation equipment of this invention. In the color picture formation equipment which is equipped with two or more image formation sections which it became independent of for [each] colors, and performs toner recycle. The toner which carries out color mixture within a cleaning means by making electrification polarity of each color toner the same is developed like the coloring toner.

beforehand held in each development means. By this Recycling a color toner, a reservoir within the development means of the toner which carried out color mixture can be prevented, and the stable image quality can be maintained.

[0024] Moreover, in the color picture formation equipment which is equipped with two or more image formation sections which it became independent of for [each] colors, and performs toner recycle, while making electrification polarity of each color toner the same By making the same the binding resin used for each coloring toner, unify the electrification train of each quality of the material, and an action is made in agreement with the toner which fixed the frictional electrification property and carried out color mixture, and the coloring toner beforehand held in a development means. By this The stable image quality can be acquired recycling a color toner.

[0025] Furthermore, in the color picture formation equipment which is equipped with two or more image formation sections which it became independent of for [each] colors, and performs toner recycle, while making electrification polarity of each color toner the same A touch area with the material which performs frictional electrification of a toner by making the same the particle size distribution of each color toner is unified, the amount of electrifications of a toner is set constant between each color toner, and thereby, the stable image quality can be acquired, recycling a color toner.

[0026] The stable image quality is maintainable, recycling a color toner by having two or more image formation sections which it became independent of for [each] colors further again, and making the same specification of two or more development means for [each] colors in the color picture formation equipment which performs toner recycle, while making electrification polarity of each color toner the same.

[0027] While having two or more image formation sections which it became independent of for [each] colors further again, making a development means into a 2 component development means in the color picture formation equipment which performs toner recycle and making the same electrification polarity of each color toner in the two component developer of each color, the stable image quality is maintainable, recycling a color toner by making the same the carrier in the two component developer of each color.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the outline block diagram showing the full color system which is 1 operation gestalt of the image formation equipment of this invention.

[Drawing 2] It is drawing showing the result of having investigated the relation of the reverse transcription phenomenon and imprint conditions which are generated by the full color system shown in drawing 1 .

[Description of Notations]

1-1, 1-2, 1-3, 1-4 Photo conductor

2-1, 2-2, 2-3, 2-4 Electrification means

3-1, 3-2, 3-3, 3-4 Exposure means

4-1, 4-2, 4-3, 4-4 Development means

5-1, 5-2, 5-3, 5-4 Imprint means

6-1, 6-2, 6-3, 6-4 Cleaning means

7 Conveyance Belt

8-1, 8-2, 8-3, 8-4 Recycle means

9-1 First Image Formation Section

9-2 Second Image Formation Section

9-3 Third Image Formation Section

9-4 Fourth Image Formation Section

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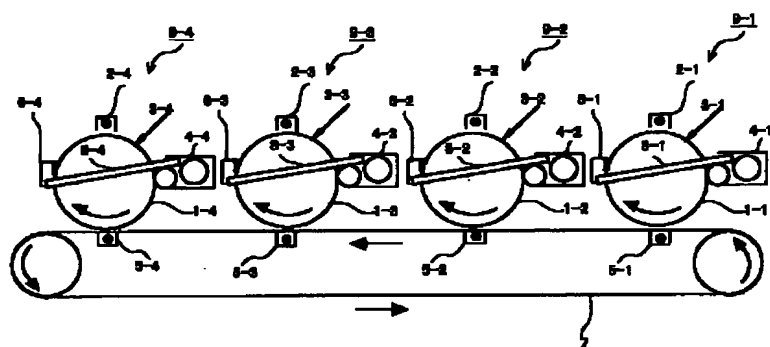
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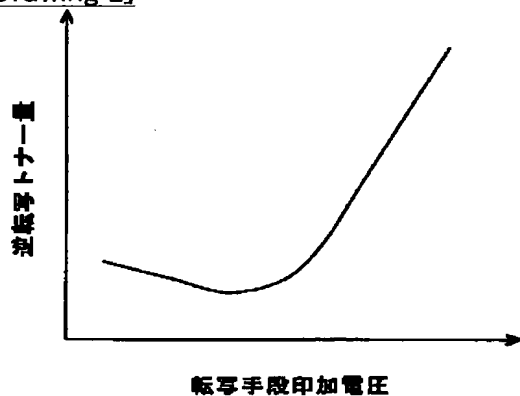
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DRAWINGS

[Drawing 1]



[Drawing 2]



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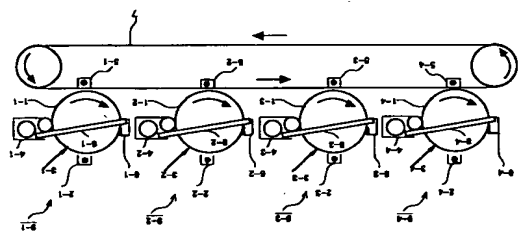
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(54) 【発明の名称】 カラー画像形成装置

(57) 【要約】
【課題】 各色用の独立した複数の画像形成部を備える、カラー画像形成装置において、トナーの混色による現像トラブルを低減しながらトナーリサイクルを行い、長期に渡り良好なカラー画像を形成することが可能なカラー画像形成装置を提供する。
【解決手段】 トナーリサイクルを行うカラー画像形成装置において、各色トナーの帯電極性及び粒度による、各色トナーの決着性能及び粒度分布を同一とする。さらに、各色用の現像手段4-1、4-2、4-3、4-4をすべて同一仕様とする。さらにまた、二成分現像剤を用いる場合には、各色現像剤中のキャリアを同一とする。



【発明の概要】

【請求項1】 表面に静電潜像が形成される複数の像担持体と、互いに異なる着色剤からなる複数の現像剤を収容し、前記複数の像担持体のそれぞれに形成された静電潜像を、対応する着色剤を有する前記現像剤によって現像する複数の現像装置と、前記複数の像担持体上に残留する余剰の現像剤を像担持体毎に除去し、回収する複数のクリーニング手段と、前記クリーニング手段によって回収されたトナーを、それぞれの現像装置内に戻すトナーリサイクル手段とを有し、前記複数の像担持体上に形成されたトナー像を、順次記録媒体上で重ね合わせて転写し、最終画像を得ると共に、前記複数の像担持体から除去された各現像剤を再度使用するカラー画像形成装置において、前記複数の現像剤の異なる着色剤は、同一の帯電極性を有することを特徴とするカラー画像形成装置。
【請求項2】 前記複数の現像剤の異なる着色剤は、同一の解着性能を有することを特徴とする請求項1に記載のカラー画像形成装置。
【請求項3】 前記複数の現像剤の異なる着色剤は、ほぼ同一の粒度分布を有することを特徴とする請求項1又は請求項2に記載のカラー画像形成装置。
【請求項4】 前記現像装置は、同一の仕様が有することを特徴とする請求項1、請求項2又は請求項3に記載のカラー画像形成装置。
【請求項5】 前記現像装置は、トナーとキャリアからなる二成分現像剤を収容する二成分現像装置であり、前記複数の現像剤は、同一のキャリアを有することを特徴とする請求項1、請求項2、請求項3又は請求項4に記載のカラー画像形成装置。
【発明の詳細な説明】
【0001】
【発明が属する技術分野】 本発明は、像担持体上に形成された静電潜像を各色の現像剤によって現像し、フルカラーの最終画像を得る複写機、プリンター、ファクシミリ等のフルカラー画像形成装置に関する。
【0002】
【従来の技術】 一般に、電子写真方式の画像形成装置においては、感光層を有する感光体の表面に帯電させた後、露光を行って感光体の表面に静電潜像を形成し、この静電潜像をトナーにより現像してトナー像を形成し、さらにこのトナー像を転写紙に転写して画像形成を行う。一方、転写後の感光体表面には、転写されなかったトナーが残留しており、この残留トナーをクリーニング装置により除去して新たな画像形成に備える。クリーニング装置によって除去されたトナーは、クリーニング装置内に回収された後廃棄されるが、この場合、トナー回収率が充満する度に廃棄作業を行う煩雑さ、廃棄トナーによる環境汚染の問題及び現像剤の利用が有効に成されなさいといった問題を有している。

【0003】 このため、最近、単色のトナーを用いる画像形成装置では、例えば、特開昭56-21175号公報に開示されるように、クリーニングされ、回収されたトナーを現像手段内に戻し、再度現像に使用するトナーリサイクル機構が広く用いられてきている。また、トナーについても、残トナーの搬送性及び耐久性を向上させ、廃棄トナーを減少させる技術として、例えば、特開平1-214874号公報及び特開平2-110572号公報に開示されるようにトナーの構成を改善したり、特開平2-157765号公報に開示されるように二成分現像のトナーにおいて、トナー粒度分布を改善する方法が提案されている。
【0004】 近年、コンピュータ、カラーファクシミリ、カラープリンタ等の開発により、フルカラー画像形成装置の需要が増大しつつあり、これに伴い、回収トナーも増加してきている。このような回収トナーの廃棄についても、フルカラーで使用するトナー量が単色で使用するトナー量に比べて多いため、回収トナーを廃棄するために貯蔵しておく容器が大型化すること、有毒性の物質を含んでいること等の問題から、フルカラー画像形成装置では、単色画像形成装置よりもトナーリサイクルの必要性が強調されてきている。しかし、従来のフルカラー画像形成装置においてトナーリサイクルを行う場合、感光体上の静電潜像を各色の現像手段で現像し、転写紙に転写した後、転写残留トナーをクリーニング等でクリーニングし、回収された残トナーを共有の残トナー回収容器に集める構成としているため、集められた残トナーは各色のトナーが混じり合った状態となり、再びカラー現像に用いることはできなかった。
【0005】 この問題に対処する方法として、各色毎の複数の感光体と各感光体専用のトナーリサイクル装置を備え、各色のトナー像が形成され、転写が行われた後の感光体上に残留するトナーを個別にクリーニングし、色別のトナー回収容器に回収して再度現像に使用する技術が、特開平9-288397号公報に開示されている。
【0006】
【発明が解決しようとする課題】 しかしながら、上記の従来の技術には、以下に示す問題がある。特開平9-288397号公報に開示される方法は、各色毎の複数の感光体を設け、専用のトナーリサイクル装置で各色トナーを色別に回収することによって、フルカラー画像形成装置におけるトナーリサイクルを可能としているが、実際には混色が発生する。このような混色の原因を解析した結果、現像手段に配置されたカラートナー像を転写する工程で、その現像手段の上流にある現像手段で既に転写されているトナー像の一部が感光体に逆転写し、転写トナーと共にクリーニング手段に混入していることが判明した。そして、この逆転写現象を完全になくすることはできないため、上記の装置において混色を避けるこ

とはできない。

【0007】本発明は、上記のような問題点に鑑みて成されたものであり、その目的は、カラー画像形成装置において、トナーの濃色による現像トラブを低減し、トナーリサイクルを行い、長期に渡り良好なカラー画像を形成することが可能なカラー画像形成装置を提供することである。

【0008】

【課題を解決するための手段】上記の問題点を解決するために、請求項1に記載の発明は、表面に静電層が形成される複数の像担持体と、互いに異なる着色剤から成る複数の現像剤を収容し、前記複数の像担持体のそれぞれに形成された静電層を、対応する着色剤を有する前記現像剤によって現像する複数の現像装置と、前記複数の像担持体上に残留する余剰の現像剤を像担持体毎に除去し、回収する複数のクリーニング手段と、前記クリーニング手段によって回収されたトナーを、それぞれ現像装置内に戻すトナーリサイクル手段とを有し、前記複数の像担持体上に形成されたトナー像を、順次記録媒体上で重ね合わせて転写し、最終画像を得ると共に、前記複数の像担持体から除去された各現像剤を再度使用するカラー画像形成装置において、前記複数の現像剤の異なる着色剤が、同一の帯電極性を有するカラー画像形成装置を提供する。

【0009】請求項2に記載の発明は、前記複数の現像剤の異なる着色剤が、同一の結着剤を有する請求項1に記載のカラー画像形成装置を提供する。

【0010】請求項3に記載の発明は、前記複数の現像剤の異なる着色剤が、ほぼ同一の粒度分布を有する請求項1又は請求項2に記載のカラー画像形成装置を提供する。

【0011】請求項4に記載の発明は、前記現像装置が、同一の仕様を有する請求項1、請求項2又は請求項3に記載のカラー画像形成装置を提供する。

【0012】請求項5に記載の発明は、前記現像装置が、トナーとキャリアから成る二成分現像剤を収容する請求項1、請求項2、請求項3、請求項4又は請求項5に記載のカラー画像形成装置を提供する。

【0013】

【発明の効果】以下、本発明のカラー画像形成装置の基本的形態を図に基づいて説明する。図1は、本発明の請求項1、請求項2、請求項3、請求項4又は請求項5に記載のカラー画像形成装置を示す概略構成図である。このカラー画像形成装置は、4つのドラム状の感光体を有するフルカラーシステムであり、第一画像形成部9-1、第二画像形成部9-2、第三画像形成部9-3及び第四画像形成部9-4の独立した4つの画像形成部を有する。これらの画像形成部9-1、9-2、9-3、9-4は、それぞれ像担持体である感光体1-1、

一は、それぞれトナー供給ローラにより現像ローラ上に搬送され、現像ローラの回転に伴って現像ローラ上に積み上げられ、現像領域に搬送されて静電層上に吸着され、各色のトナー像が形成される。感光体1-1、1-2、1-3、1-4の表面に形成された各色のトナー像は、感光体の回転によって、さらに転写手段5-1、5-2、5-3、5-4が配置された位置に搬送され、搬送ベルト7によって搬送された記録紙に、まず、第一画像形成部9-1のイエロートナーによるトナー像が転写される。このイエロートナー像が転写された記録紙は、搬送ベルト7上を搬送され、第二画像形成部9-2、第三画像形成部9-3及び第四画像形成部9-4へと順次移動し、マゼンタトナーによるトナー像、シアントナーによるトナー像及びブラックトナーによるトナー像が次々に重ね合わされ、フルカラー画像として転写された後、図示しない定着手段に搬送され、記録紙に定着されたフルカラー画像が形成される。

【0016】上記のトナー像転写後に感光体1-1、1-2、1-3、1-4の表面に残留した各色のトナーは、感光体の回転によってクリーニング手段6-1、6-2、6-3、6-4の配置位置に搬送され、感光体の表面に接触配置されたトナープレート7によってそれぞれ感光体表面から剝離されると共に、クリーニング手段6-1、6-2、6-3、6-4内に回収され、ここからリサイクル手段8-1、8-2、8-3、8-4を通じて現像手段4-1、4-2、4-3、4-4内に誘導され、新規トナーと混合されて再び現像に使用される。

【0017】本実施形態では、それぞれの画像形成部9-1、9-2、9-3、9-4が独立しており、各画像形成部のクリーニング手段6-1、6-2、6-3、6-4は、同一の画像形成部内の感光体1-1、1-2、1-3、1-4の表面に残留するトナーを除去する。このため、各クリーニング手段内には、対応する色のトナー（イエロートナー、マゼンタトナー、シアントナー又はブラックトナー）のみが存在するはずであるが、実際に、複数のトナーが存在している。このフルカラーシステムで画像形成後にクリーニング手段6-1、6-2、6-3、6-4内のトナーを調査したところ、第一画像形成部のクリーニング手段6-1内には第一色のトナー（イエロートナー）が、第二画像形成部のクリーニング手段6-2内には第一色のトナー及び第二色のトナー（マゼンタトナー）が、第三画像形成部のクリーニング手段6-3内には第一色のトナー、第二色のトナー及び第三色のトナー（シアントナー）が、第四画像形成部のクリーニング手段6-4内には第一色のトナー、第二色のトナー、第三色のトナー及び第四色のトナー（ブラックトナー）が存在しており、N番目の画像形成部のクリーニング手段内に存在するトナーは、第N色のトナー一及びそれよりも前のすべての色のトナー（但し、この場合、Nは1-4のいずれかの数）であることがわかつ

た。

【0018】このように、クリーニング手段6-1、6-2、6-3、6-4内に複数の色のトナーが存在する原因を解析した結果、各画像形成部の現像手段4-1、4-2、4-3、4-4において、その現像手段内に収容される着色トナーのトナー像を転写する工程で、その画像形成部の上流に配置される画像形成部で既に転写し、転写されているトナー像の一部が感光体に吸着され、転写手段トナーと共にクリーニング手段へ搬入していることが判明した。例えば、第二画像形成部9-2の現像手段4-2に収容される第二色のトナー（マゼンタトナー）でトナー像を転写時に、この転写時には、第一画像形成部9-1ですでに第一色のトナー（イエロートナー）によるトナー像が転写されており、このイエロートナー像の一部が第二画像形成部の感光体1-2上に逆転写するため、転写手段トナーとしてイエロートナーとマゼンタトナーの2種類のトナーが感光体1-2上に存在する。これらのトナーはクリーニング手段6-2段6-2内に回収されるので、クリーニング手段6-2内には、イエロートナーとマゼンタトナーが混在することになる。

【0019】さらに、この逆転写現象の発生と転写条件（トナーを転写紙へ移動させる転写電圧を発生させるために転写手段に印加する電圧の条件）との関連を調べた。この結果、図2に示すように、逆転写トナー量が最少となる条件は存在するが、逆転写トナーが0となることはないことが判明した。この結果から、逆転写トナーの配電紙から感光体側への移動は、静電気力以外の力に依存して行われるものと考えられた。そして、通常、この力を制御することはできない。したがって、以下は、ク生を0とすることはできない。したがって、以下は、クリーニング手段内にある程度の濃色のトナーが存在することを前提として述べる。

【0020】現像されない濃色したトナーを現像手段内に溜め込んでしまうと、トナーを導電層で電圧を印加して二成分現像方式ではキャリア、一成分現像方式では現像ローラ）にフィルムミグを起したり、トナー濃度制御御ができなくなるなどの不具合が生じるが、実際には、逆転写等で濃色の上流側のトナー量は、非常に適量であり、現像手段内に溜まらずにその現像手段内に本来収容されている着色トナーと同様に現像されていけば、大きな不具合を生じることはない。このため、濃色したトナーは、本来のトナーと共に現像され、現像手段内に溜まらぬことが望ましい。濃色トナーも同時に現像される状態では、濃色比率は逆転写トナー量に依存する。仮に、逆転写により濃色するトナー量を現像トナー量の5%とすると、最終的な濃色比率も5%で飽和する。

【0021】濃色トナーを通常の現像で現像するためには、本実施形態では、各色用の4つの現像手段をすべ

7 同一の仕様とした。このように、現像手段について、特に現像ローラとして同一仕様の部材を用い、同一の条件で現像することにより、着色したトナーを本来の色のトナーと同様に現像することができる。また、本実施形態では、トナーとキャリアから成る二成分現像剤を用い、トナーとキャリアについて、以下のような材料を用いた。トナーは、各色トナーの帯電極性をマイナスイオンとし、各色トナーを形成する結着樹脂をすべてポリエステル樹脂とし、さらに、各色トナーの粒度分布をすべて平均粒度6.5 \pm 0.5 μ mとし、また、キャリアについて、各色共、同一のものを使用し、反転現像を行う構成とした。このような構成を有する本実施形態のフルカラーシステムでカラー画像形成を行ったところ、トナーリサイクルを実施してもトナーが混色して現像手段内に溜まらず、安定した画像品質が得られることが確認された。

【0022】上記の構成において、各色間で結着樹脂が異なるトナーを用いた場合には、各材質の帯電率が異なるため、帯電極性が変化し、混色トナーと本来の着色トナーとで異なる挙動を示し、安定した画像を得ることができない。また、各色トナーの粒度分布が異なる場合には、混色したトナーと本来の着色トナーとで粒度分布が異なり、トナーと結着樹脂とされる材料（二成分現像剤）ではキャリア、一成分現像剤方式では現像ローラ）との接触面積が変化し、着色トナーと本来の着色トナーとで平均的な帯電極性に差が生じる。このため、このようなトナーは、現像時に互いに異なる挙動を示し、画像形成に影響を及ぼす。例えば、すべての着色トナーの平均粒径を6.5 \pm 0.5 μ mとした場合と、ブラックトナーの平均粒径を10.0 \pm 0.5 μ mとし、ブラックトナーを除くすべてのトナー（イエロー、マゼンタ、シアン及びシアントナー）の平均粒径を6.5 \pm 0.5 μ mとした場合とで、トナーリサイクルを実施する現像手段と比較したところ、すべての着色トナーの平均粒径を同一範囲とした場合には、混色トナーと本来の着色トナーと同様に現像されたのに対し、ブラックトナーの平均粒径が他の着色トナーの平均粒径と異なる範囲とした例では、平均粒径の小さい着色トナーがベタ画像のエッジ部に集中する選択現象が発生した。したがって、各色用の現像手段をすべて同一仕様とし、各色トナーの帯電極性及び粒度分布が同一であり、同一の結着樹脂を用いる。二成分現像剤では同一のキャリアを用いた現像剤を使用することにより、カラートナーのリサイクルを行いながら、安定した画像品質を得ることが可能となることがわかった。

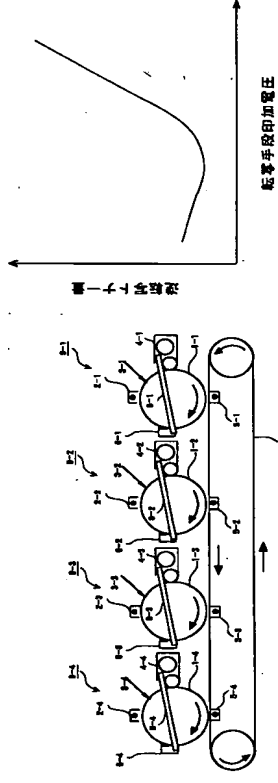
【0023】
【発明の効果】以上説明したように、本発明のカラー画像形成装置は、各色用の独立した複数の画像形成部を備え、トナーリサイクルを行うカラー画像形成装置において、各色トナーの帯電極性を同一とすることにより、カラートナーのリサイクルを行いながら、安定した画像品質を得ることができ、安定的に画像品質を維持することができる。

【図面の簡単な説明】
【図1】本発明の画像形成装置の一実施形態であるフルカラーシステムを示す概略構成図である。
【図2】図1に示すフルカラーシステムで発生する逆転写現象と転写条件との関連を調査した結果を示す図である。

【符号の説明】
1-1、1-2、1-3、1-4 感光体
2-1、2-2、2-3、2-4 帯電手段
3-1、3-2、3-3、3-4 露光手段
4-1、4-2、4-3、4-4 現像手段
5-1、5-2、5-3、5-4 転写手段
6-1、6-2、6-3、6-4 クリーニング手段
7 搬送ベルト
8-1、8-2、8-3、8-4 リサイクル手段

9 9-1 第一画像形成部
9-2 第二画像形成部
9-3 第三画像形成部
9-4 第四画像形成部

【図1】



【図2】

フロントページの続き

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